SPECIFICATIONS

1. MATERIALS

• Pipes and fittings shall be inspected and will undergo testing on the manufacturers premises before delivering to the temporary storage area of the contractor and shall be witnessed by the PWD technical staff

• Pipes and fittings will be randomly tested and shall pass the minimum and maximum requirement. Specifications (Please refer to pipes and fittings specification)

PIPE SPECIFICATIONS:

HDPE PIPE CLASS: SDR 13.5 Standard Dimension Ratio
Nominal Size 6 inches
Internal
Diameter -- 150mm
Length/piece --- 6 meters
Markings on Pipe --- "Manufacturer, SDR 13.5, Outside diameter, usage of pipe(for water), Production date/Number"
Provide Laboratory Test results of Pipe Materials conforming to ISO 1167
Elastic Suitable for underground pipes through adjustment to local ground movement

Impact-resistant and tough Unbreakable

Thermal resistant
Application possible between -40°C and 100°C
Smooth internal wall
Low blockage risk due to low deposit/residue effects
Weather-resistant/UV resistant
Application in open air unrestricted
Wear resistant
Lower cost due to relative long life
Insulating
Non conductive
Chemical resistant
Suitable for transport of polluted waste water
Poor heat conductivity

No condensation possible during short periods of cooling
Non-toxic
Environmental friendly

Highly suitable for welding
Easy installation using butt-welding and electro fusion techniques
Homogeneous welded joints
Pull tight and leak proof
Sample testing will be conducted as part of Post qualification procedure
Quick Burst Pressure – 550 psi @ 60 Sec
Sustained Pressure - 150 psi @ 2 hours
Environmental stress cracking test
Weighing Test

GATE VALVES

Size : 150mm and 100mm diameter
Material : Cast Iron
Type: Mechanical

VALVE BOX with Cover

Size : 150mm diameter
Material : Plastic

TEE COUPLING

Size: 6" x 6" diameter, 6" x 4" diameter
Materials : Fabricated High Density Polyethylene
Type : Mechanical

ELBOW COUPLING

Size : 150 mm diameter
Materials : Fabricated High Density Polyethylene
Type: Thermally fused

2. WORKMANSHIP

2.1 CONSTRUCTION METHODOLOGY

The contractor must provide road safety provisions such as barricades, tower light with rope light. The workers on the other hand should be provided with traffic warning vest and other construction safety accessories.

In order to minimize traffic congestion during working hours, excavation will be limited to the capacity of workers to lay pipes and backfill/ compact during designated working hours. The contractor shall also provide steels plates and shall maintain a clean working

area especially after the working hours. All excess excavated materials will be hauled to the owner's designated dumpsite.

2.2 TRENCH EXCAVATION

Before excavation is opened, be sure contractors has made provision to ensure public safety by use of warning devices, such as barricades, warning signs, and flagman, etc. Trench should be straight with vertical sides, centered on pipe center line. Trench bottom must be uniform, free of humps, abrupt change of direction, large stones, rocky operation and tree roots. Do not open the trench too far in advance of pipe laying. Refer to specifications for requirements. Avoiding long stretches of open trench will:

- Reduce or even eliminate, pumping or sheeting.
- Reduce caving caused by ground water.
- Minimize the possibility of flooding the trench.
- Reduce caving caused by ground water.
- Reduce hazards to traffic and workmen.

Water must be kept out from trench during construction so, that pipe will not contaminate. Pumps should be used in the trench. If necessary, to remove any build up water. The contractor should have on hand a sufficient number of pumps in good working condition. Be sure sanitation facilities have been provided. Workmen must not use the trench as a toilet.

During the excavation, it may cause damage to the existing service line and distribution line. The damage line should be repaired by the contractor at their own cost.

Excavation Specification, Refer on the detailed drawing & design

2.3 LAYING PIPE

Bedding is very important. The trench bottom should be prepared by either bedding with sand or smoothing bottom. In both case it is very important that the entire length of pipe from coupling to coupling should be supported and bell hole excavated for the coupling with 50mm (2") clearance all around.

Bedding Specification, Refer on the detailed drawing & design

2.4 HANDLING AND STORAGE

Should be handled and stored in such a, manner that it will not come in contact with materials that may damage or penetrate the plastic material, or in direct rays of sun.

The following materials common to the building trades, may adversely affect pipe and damaged by such materials should be rejected:

a) Gasoline
b) Lubricating oil
c) Muriatic acid
d) Liquid or gaseous fuels
e) Acid solders
f) Aromatic compounds
g) Synthetic paint solvents
h) Turpentine
i) Paints
j) Hot water or stream
k) The Contractor shall have a Temporary Storage Facilities for its Equipment & Materials needed in the project.

Care should be taken that ground is level and free from stones. Pipes should not exceed three layers and should be staked to prevent movement. If due to unsatisfactory storage or handling, a pipe is damaged is linked, the damaged portion should be cut out completely.

2.5 THRUST BLOCKS

- Size depends on pressure, pipe size, kind of soil and type of fitting, and is indicated on the detailed drawing & design.
- Located wherever the pipe changes direction; where pressure changes can be expected (as at valve, reducers, hydrants, end caps, and some tees or crosses) and at any point where soft unstable soil may cause the pipe to slide as on slopes. In effect the thrust block transfers the load from the pipe to the wider load bearing surface of the soil.

CONSTRUCTION

- Made of 141kg/cm² (2000 psi) non-structural concrete placed between the fitting and undisturbed soil.
- Mix should be fairly dry so it can be shaped into a wedge with the widest part against the soil trench wall.
- Keep concrete behind bell of the fitting. Do not let it run over against the pipe or into the joint.
- Care should be taken to insure that concrete has filled in completely around the fitting
- Do not encase the pipe or fitting.

- Thrust blocks are not needed where joints of steel pipe have been welded, flanged or harnessed.

2.6 VALVES

a. All valves should be fitted with a valve box and cover. Refer on the detailed drawing & design.

2.7 BACK FILL & TAMPING

- Two types of tamping bars are required for a complete job. First a bar with narrow head or blade is used to tamp under the couplings. Then a bar with a flat head is used to compact soil at the sides of the pipe. (Figure 4-15).
- For packing soil under couplings, tamping bars should not be improvised from two by fours, shovel blades, pick handles and the like. A good tamping bar should be long enough to handle easily, heavy enough to do the work (but not wear the workman out) and of the right size and shape to pack soil properly. The tamping bars in Figure 4-15 will do a good job, can be handled easily and are quickly made up in the shop.

PLACING AND TAMPING IN THE PIPE ZONE

- A good tamping job can be done more easily than a poor job. The key to it is in the amount of soil that is thrown in to be tamped around the pipe.
- Prior to hydrostatic testing of pipe, the selected sandy material is placed 15cm (6") over the pipe leaving the joints exposed for observation during testing. A portion of the material is used for the remainder of trench to furnish weight to resist movement due to pressure. Pipe should be weighed to down with good soil at a rate of .3m (1 ft.) depth for each 7kg/sq cm (100 psi) water pressure.
- Initial backfill is always placed by hand. It should be shovelled in evenly along both sides of the pipe, making a layer about 10 cm (4") thick. Then the tamping bar is used to tamp this soil firmly around the pipe. Next, another 10 cm (4") layer is shovelled in and tamped. This is repeated until the pipe is firmly bedded in compact soil.
- The Contractor may compact by using an excess of water so that sand is almost fluid, and a concrete vibrator to settle the sand much the way concrete is settled. This method only works in a sandy material.

PLACING BACKFILL IN REMAINDER OF TRENCH

- If the pipe zone backfill was placed in layers and tamped, the remainder of the trench may be backfilled immediately. If the pipe zone backfill was compacted by flooding and vibrating, then at least 4 hours must lapse before the next layer is started. This gives the water used in flooding sufficient time to percolate out of the trench.
- Layer Method
  a.) Backfill should be placed in 10 to 15 cm (4"-6") layers with each layer being carefully compacted before the next layer is placed.
  b.) Flooding and Jetting cannot be used in clay since clay expands when wet and shrinks as it dries out, thereby creating voids which lead to eventual settling. Used when material is sandy and in trenches where water drains away quickly.
  c.) Place in layers not greater than 90 cm (36"). Compact each layer by rodding, jetting and rodding. Be sure backfill material has become saturated and rodding is being done at intervals close enough (usually 60 cm or 2 ft) to settle the fill.
  d.) Be sure precautions are being taken not to damage pipe with jet pipe or rod. Do not let jet pipe or rod come in contact with enamel coated pipe.
  e.) Use enough water to settle backfill around pipe; otherwise voids may be formed around the pipe.
  f.) When jetting, watch for backfill to settle. The jetting operation is staggered on each side of the trench about 3' apart.
  g.) If pipe trench is on a slope, jetting should proceed from the lower elevation. The consolidated backfill will prevent the water from running down hill and causing possible erosion under the pipe.
- General cleanup should follow immediately behind the backfill.

2.8 HYDROTESTING

PREPARATION

- All thrust blocks are cast and set.
- Cap and brace all pipe ends to prevent movement.
- Make provisions to relieve air from high points and pipe end. Compressed entrapped air causes difficulty in pumping up to the required pressure. A pipeline may leak compressed air when it is not actually watertight and may show erroneous results during the test.
- Backfill 45 cm (18") over pipe, to ensure from movement, leaving the joints opens for usual inspection.
- Locate pump and pressure gauge at low point of line if possible.
- Provide means to measure water that is added during test period to maintain required pressure.

- Service connections and fire entire line to be completed. Test by sections, generally not in excess of 200 m (656 ft), so repairs and backfill can be completed as the work progresses. Also mistakes in installation can be noted and corrected before a lot of pipe has been laid.

PROCEDURE

- Fill slowly from the point in the line if possible. This helps expel trapped air.
- Thoroughly flush line prior to any testing. Minimum flushing velocity is 2.5 feet per second.
- After filling, pipe must stand for 48 hours under slight pressure to allow air to escape from pockets and for lining to soak up. During the period visually examine all joints for leaks and feel the underside of joints and fitting for water that may be seeping from a leak.
- Never use air to develop test pressure.
- Pressure in the pipeline may be brought up to the 10.6kgf/sq.cm (150 psi) test pressure and maintained by use of a hand pump, a non-automatic power pump or an automatic pump, the pipe line pressure shall not be allowed to drop more than 5 psi. Pressure at the end of the test period should be same as the beginning.
- Water usage may be metered by a recently calibrated water meter or by using water from a clean container which has been calibrated or can be easily measured and computed.
- Fire hydrant laterals and service connections are tested with the main line.

LEAKAGE ALLOWANCE LIMITS
Table 4-3.

Diameter		Allowance Per Hour	
mm	inch	liters	gallons
150	6	3.25	0.85
200	8	4.35	1.15
250	10	6.52	1.72

- For best results, care must be taken during the construction phase that pipes and fitting are clean when installed and that debris, dirty water, animals, etc. are prevented from entering the pipe. All openings must be closed with water tight plugs when pipe lying is not in progress and at the end of each work day.
- Hydrostatic testing has been completed.
- Flushing has been completed.

a.) Flushing is not a substitute for maintaining a clean pipe and should not be expected to remove deposits that are caked in the pipe.

- Compute pipe line capacity to determine amount of chlorine needed.

2.9 DISINFECTION

PREPARATION
CHLORINE

- Gas
    a. Packaged in cylinders usually of 68kg. or 1000kg. (150lb. or 1 ton) capacity.
    b. Chlorine is liquid under pressure and becomes vapor (gas) at atmosphere pressure.
    c. To be used only when suitable equipment is available and only by person totally familiar with the properties of liquid chlorine.
    d. Equipment should consist of a solution feed chlorinator in combination with a booster pump for injecting the chlorine-gas water mixture into the main to be disinfected.
- Calcium Hypochlorite (Chlorine Powder or "HTH").
    a. Contains 70 percent available chlorine by weight.
    b. Either granular or tabular.
    c. 6 to 8 tablets per ounce.
- Sodium Hypochlorite(Liquid Bleach)
    a. Supplied in strengths from 5.25 to 16 percent available chlorine.
    b. Packaged in liquid form in glass, plastic or rubber containers.
- Miscellaneous Information
    a. 3.78 kilograms (8.33 pounds available chlorine will) of 100% available chlorine will treat 3785 kiloliters (1,000,000 gallons) of water at a rate of 1 mg/1 (1ppm).
    b. 5.41 kilograms (11.9 pounds) of 70% available chlorine will treat 3785 kiloliters (1,000,000 gallons) of water at a rate of 1 mg/1 (1ppm).
    c. Chlorine gas is 2½ times heavier than air.